Claims

1. A sensor- and/or separating element for the semi-permeable diffusion of molecules comprising:

a) a mechanically stable substrate having at least one through-opening,

b) a perforated membrane which is fluid-tighly connected to the substrate and extends at least across the through-opening; and

c) at least one semi-permeable layer which is applied in firmly adhering manner to one or both sides of the membrane at least in the perforated region thereof, wherein the semi-permemable layer or semi-permeable layers is/are secured mechanically in the adjacent perforations and/or by chemical-structural and/or physical adhesion and/or adhesive intermediate layers and/or covalent surface bonding to the adjacent surfaces of the membrane, optionally of the substrate, or of a metallic film optionally additionally applied to one or both sides of the membrane.

2. A sensor- and/or separating element according to claim 1, wherein the substrate and the membrane are made of similar or different materials from the group consisting of mechanically stable, inorganic and organic materials.

3. A sensor- and/or separating element according to claim 2, wherein the substrate and the membrane are made of similar or different organic polymers.

4. A sensor- and/or separating element according to claim 3, wherein the organic polymers are from the group consisting of polycarbonate, polystyrene, polytetrafluoroethylene and polyamide.

5. A sensor- and/or separating element according to claim 2, wherein the material of the membrane differs from the material of the substrate in respect of its processibility by a predetermined chemical and/or physical processing means, such that the substrate can be removed by the processing means whereas the membrane substantially cannot be attacked by the processing means.

6. A sensor- and/or separating element according to claim 5, wherein the materials of the substrate and the membrane are chosen from the group consisting of silicon, one or more silicon compounds and/or a material containing silicon and/or another semiconductor material.

7. A sensor- and/or separating element according to claim 6, wherein the substrate is of silicon and the membrane is of epi-silicon.

8. A sensor- and/or separating element according to claim 1, characterised in that the membrane is an ultra-thin membrane whose thickness ranges between 20 μm and 100 nm.

9. A sensor- and/or separating element according to claim 1, characterised in that the semi-permeable layer is a polymer layer, preferably composed of an organic, preferably adherent, polymer.

10. A sensor- and/or separating element according to claim 1, characterised in that the perforations have a diameter or maximum diameter which ranges between 0.1 and 50 μm, preferably 1 and 10 μm.

11. A sensor- and/or separating element according to claim 1, characterised in that the optional metallic film extends over a region of the substrate or over a region of the membrane underlaid by the substrate.

12. A sensor- and/or separating element according to claim 1, characterised in that a metallic film or a plurality of metallic films is/are provided, which consist(s) of individual segments which are separate from one another and each of which is provided with at least one electric terminal.

13. A sensor- and/or separating element according to claim 11, characterised in that a further metallic film or one or more further double layer(s) of metallic film plus semi-permeable layer are applied to the exterior of one or both of the semi-permeable layers, where optionally a final metallic film is applied to the outermost semi-permeable layer and where all the further metallic films are perforated in the region of the through-opening.

14. A process for the production of a sensor- and/or separating element for the semi-permeable diffusion of molecules, comprising the following process steps:

(a) providing a mechanically stable substrate;

(b) forming at least one through-opening in the substrate;

(c) fluid-tightly connecting a membrane to the substrate such that the membrane extends at least across the through-opening;

(d) forming perforations through the membrane in the region of the through-opening(s);

(e) applying at least one semi-permeable layer in firmly adhering manner to one or both sides of the membrane at least in the region thereof spanning the through-opening, preferably also to the adjacent region of the substrate, in that the semipermeable layer or semi-permeable layers is/are secured mechanically in the adjacent perforations and/or by chemical-structural and/or physical adhesion and/or adhesive intermediate layers and/or covalent surface bonding to the adjacent surfaces of the membrane and optionally of the substrate.

15. A process according to claim 14, further applying a metallic film on one or both sides of the membrane and forming one or more electrical terminals connected to or formed by the membrane(s).

16. A process according to claim 14, wherein the substrate and the membrane are made of similar or different materials from the group consisting of mechanically stable, inorganic and organic materials.

17. A process according to claim 16, wherein the substrate and the membrane are made of similar or different organic polymers.

18. A process according to claim 17, wherein the organic polymers are from the group consisting of polycarbonate, polystyrene, polytetrafluoroethylene and polyamide.

19. A process for the production of a sensor- and/or separating element for the semi-permeable diffusion of molecules, comprising the following process steps:

a) provision of an electrically conductive membrane on a mechanically stable substrate in such manner that the membrane is integral with the substrate, where the material of the membrane differs from the material of the substrate in respect of its processibility by a predetermined chemical and/or physical processing means such that the substrate can be removed by the processing means whereas the membrane substantially cannot be attacked by the processing means;

b) formation of at least one through-opening in the substrate by the processing means so that the through-opening is closed off on one side by the membrane;

c) formation of perforations in the region of the membrane extending across the through-opening;

d) application of at least one semi-permeable layer in firmly adhering manner to one or both sides of the membrane at least in the region thereof spanning the through-opening, preferably also to the adjacent region of the substrate, in that the semipermeable layer or semi-permeable layers is/are secured mechanically in the adjacent perforations and/or by chemical-structural and/or physical adhesion and/or adhesive intermediate layers and/or covalent surface bonding to the adjacent surfaces of the membrane and optionally of the substrate;

e) formation of one or more electric terminals connected to or formed by the membrane.

20. A process for the production of a sensor- and/or separating element for the semi-permeable diffusion of molecules, comprising the following process steps:

a) provision of an electrically insulating or semiconducting membrane on a mechanically stable substrate, such that the membrane is integral with the substrate, where the material of the membrane differs from the material of the substrate in respect of its processibility by a predetermined chemical and/or physical processing means, such that the substrate can be removed by this processing means whereas the membrane

substantially cannot be attacked by the same processing means;

b) formation of at least one through-opening in the substrate by the processing means so that the through-opening is closed off on one side by the membrane;

c) formation of perforations in the region of the membrane extending across the through-opening;

d) application of at least one semi-permeable layer in firmly adhering manner to one or both sides of the membrane at least in the region thereof spanning the through-opening, preferably also to the adjacent region of the substrate, in that the semipermeable layer or semi-permeable layers is/are secured mechanically in the adjacent perforations and/or by chemical-structural and/or physical adhesion and/or adhesive intermediate layers and/or covalent surface bonding to the adjacent surfaces of the membrane and optionally of the substrate or of a metallic film optionally applied to one or both sides of the membrane.

21. A process according to claim 20, characterised in that one or more electric terminals, in each case connected to the respective metallic film, is/are produced.

Sub B1

22. A process according to claim 19, 20 or 21, characterised in that the membrane is produced from mechanically stable, membrane-forming, inorganic material.

23. A process according to one of claims 19, 20, 21 or 22, characterised in that the membrane is produced from silicon, one or more silicon compounds and/or a material containing silicon.

24. A process according to one of Claims 14 to 23, characterised in that a further metallic film or one or more double layers of metallic film plus semi-permeable membrane are applied to the exterior of one or both of the semi-permeable layers, a final metallic film being optionally applied to the outermost semi-permeable membrane and all the further metallic films being perforated in the region of the through-opening.

25. A process according to one of the preceding process claims, characterised in that one or more metallic films are produced from segments separate from one another, where preferably each segment is provided with or electrically conductively connected to at least one separate terminal.

26. A process according to one of claims 14 to 25, characterised in that at least one semi-permeable layer, preferably all the semi-permeable layers, is/are formed from polymer, preferably organic and preferably adherent polymer.

27. A process according to one of claims 14 to 26, characterised in that the perforations are produced with a diameter or maximum diameter ranging between 0,1 and 50 μm, preferably 1 and 10 μm.

28. A process according to one of claims 14 to 27, characterised in that the semi-permeable layer(s) is/are applied by a spin-off process, centrifugal or fluidized-bed coating, or spin- or jet coating.

29. A process according to one of claims 14 to 28, characterised in that chemical wet-etching, plasma dry-etching, electro-erosion or thermal melting-out is employed as means of forming the through-opening(s).

30. A process according to one of Claims 14, to 29, characterised in that all or a part of the perforations are formed by photolithography in association with dry- or wet etching or by means of laser- or particle beam processing.

31. A process according to one of claims 14 to 30, characterised in that all the metallic films or a part of the metallic films is/are applied by sputtering, vapour deposition, plating, electrolytic deposition or current-free electrolytic deposition.

32. A process according to one of claims 14 to 31, characterised in that the membrane is produced as an ultra-thin membrane with a thickness ranging between 20 μm and 100 nm.

33. Use of the sensor- and/or separating element formed in accordance with one of claims 1 to 13 or produced in accordance with one of claims 14 to 32 as sub-element for the detection of electromagnetically active molecules.

34. Use of the sensor- and/or separating element formed in accordance with one of claims 1 to 13 or produced in accordance with one of claims 14 to 32 for the separation of molecules through the semi-permeable layer(s).